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DATE: 16 January 1962

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PROCESS - BRAZING - STAINLESS STEEL TO TITANIUM
EVALUATION

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TEST DATA MEMORANDUM

F-TDM NO. 2123
MODEL B-58
TEST NO. F-7204
Page 1 of 4

TEST: PROCESS - BRAZING - STAINLESS STEEL TO TITANIUM - EVALUATION OFOBJECT:

The object of this test was to determine if commercially pure titanium tubing could be satisfactorily brazed to 321 stainless steel tubing and to evaluate the resulting brazed joint.

TEST SPECIMENS & PROCEDURE:

Titanium and stainless steel tubes, 1" O.D. by .035" wall, were used for this test. The titanium tube was inserted into the expanded end of a stainless tube, with various amounts of 98% silver-2% lithium alloy foil and wire. The assembly was placed in a vycor glass tube with a flowing argon gas atmosphere. An induction coil with five turns was placed around the joint. A Westinghouse 10 kw (450 kc) induction generator was used as the heating source. The arrangement is shown in Figure 1. The brazing cycle consisted of argon purge for 5 to 10 minutes and heating to the brazing temperature of 1450 to 1500 F in 2 to 4 minutes. The brazed tubes were then examined visually and metallographic specimens prepared. Salt spray specimens were prepared and exposed 100 hours.

RESULTS & DISCUSSION:

Typical brazed tubing sections are shown in Figure 2. A photomicrograph of a brazed titanium tube to stainless steel tube is shown in Figure 3, and of a titanium tube to nickel plated stainless steel tube in Figure 4.

In all cases, up to 75% of the circumference of the tubing joint was brazed. No benefits were obtained from either silver plating the titanium tubing, or nickel plating the stainless steel tubing. All the sections of the brazed joints that were exposed to salt spray failed within 100 hours. It is felt that with improved techniques, a completely brazed joint could be obtained, but the resultant joint would still have poor salt spray resistance using the 98-2 brazing alloy.

CONCLUSION:

Stainless steel tubing can be brazed to titanium tubing with 98 silver 2 lithium brazing alloy, but the resultant joint has poor corrosion resistance in salt spray.

The tests described in this report were conducted between March 1, 1958 and July 21, 1958.

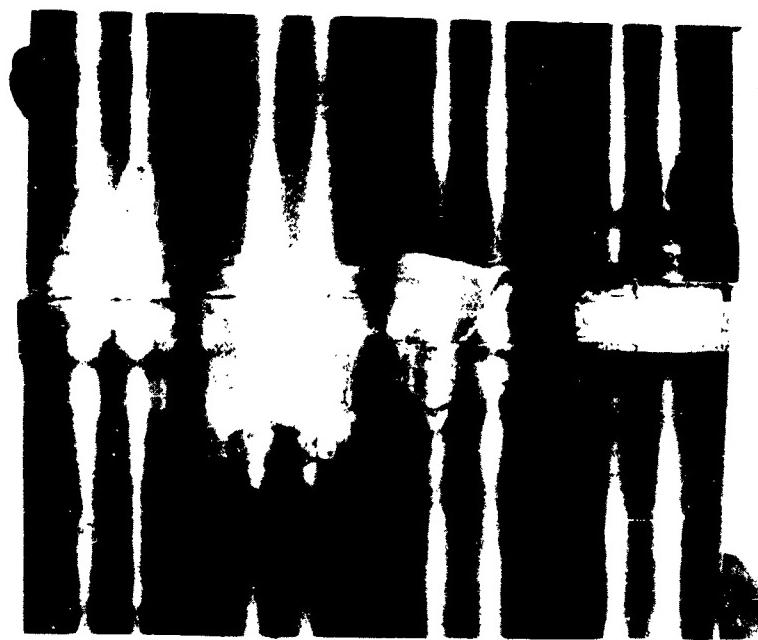
DATE 11-19-58

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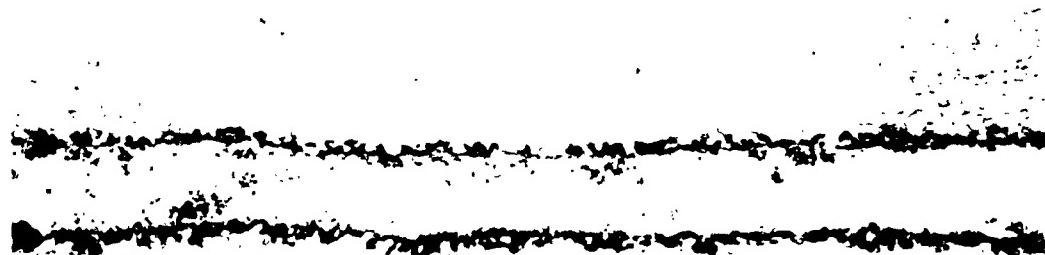
PAGE 3
REPORT NO. FTD-2123
MODEL B-58
DATE 11-19-58



Mag. 1X

Photograph of commercially pure titanium tubing
Induction brazed to 311 stainless steel tubing.
The expanded tube is stainless steel.

Figure 2



250X

Photomicrograph of joint cut from tubes shown in Fig. 2.

Etchant: 1%HF - 10% HN

Figure 3

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PAGE 4
REPORT NO. EDM-9193
MODEL 150
DATE 11-19-58



Mag. 100X

Photomicrograph of commercially pure titanium
(top) brazed to nickel plated 321 stainless
steel (bottom). Etchant - Chromic-Sulfuric Acid

Figure 4